RUST GEOTECH INC.

Spectral Gamma-Ray Borehole
Log Data Report

Borehole # 41-04-03

Log Event A

Borehole Information

Farm : SX **Tank :** SX-104 **Site Number :** 299-W23-197

N-Coord : 35,452 **W-Coord :** 75,616 **TOC Elevation :** 663.00

Water Level, ft : **Date Drilled :** 11/12/1974

Casing Record

Type : Steel-welded **Thickness :** 0.280 **ID, in. :** 6

Top Depth, ft. : 0 **Bottom Depth, ft. :** 100

Equipment Information

Logging System : 1 **Detector Type :** HPGe **Detector Efficiency:** 35.0 %

Calibration Date : 03/1995 **Calibration Reference :** GJPO-HAN-1

Logging Information

Log Run Number : 1 **Log Run Date :** 5/15/1995 **Logging Engineer:** Bob Spatz

Start Depth, ft.: 0.0 **Counting Time, sec.:** 100 **L/R :** L **Shield :** N

Finish Depth, ft. : 78.0 **MSA Interval, ft. :** 0.5 **Log Speed, ft/min.:** n/a

Log Run Number : 2 **Log Run Date :** 5/16/1995 **Logging Engineer:** Bob Spatz

Start Depth, ft.: 99.5 **Counting Time, sec.:** 100 **L/R :** L **Shield :** N

Finish Depth, ft. : 77.0 **MSA Interval, ft. :** 0.5 **Log Speed, ft/min.:** n/a

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Analysis Information

Analyst : P.D. Henwood

Data Processing Reference : Data Analysis Manual Ver. 1 Analysis Date : 7/12/1995

Analysis Notes :

This borehole was logged with the spectal gamma-ray logging system in two log runs: run 1 from 0 to 78 ft, and run 2 from 99.5 to 77 ft with a 1 ft overlap from 77 to 78 ft. All log data were recorded at 0.5-ft stations with a 100-s counting time. The pre- and post-survey field verification spectra from both log runs showed consistent peak activities, but energy calibrations differed due to gain drift in the instrumentation. Spectra were recalibrated for energy versus channel where appropriate.

The casing thickness shown on the drilling log is 5/16 (0.3125 in.). This could not be confirmed in the field. The casing correction used in the analysis was that for a casing of 0.33 in. thick. Therefore, the reported concentrations may be slightly higher than actual.

A zone of contamination was found at 20 ft containing Cs-137, Co-60 and Eu-154. This zone also appears to contain significant levels of Sr-90. This is indicated by the elevated low-energy background in the spectra near 20 ft in depth. The elevated background is due to bremsstrahlung radiation resulting from high-energy beta radiation such as Sr-90. At the present time, there are no software routines that can positively confirm the presence of bremsstrahlung radiation and there are none to quantify Sr-90 concentrations.

Cs-137 was also detected from the surface to about 14 ft at concentrations up to about 5 pCi/g and was detected slightly above the MDA at several discontinuous locations throughout the borehole.

Log Plot Notes:

Four log plots and one spectrum plot are used to report the data for this borehole.

A separate log plot is provided for the Cs-137 data to document the concentration and show the shape of the distribution of this contamination. This plot shows the calculated MDA value as small open circle data points. The estimated error of the concentration is shown with error bars that represent the 95 percent confidence interval for that estimation. This log plot shows the 20-ft depth contamination zone to have a Cs-137 concentration of about 5 pCi/g. Note that the Cs-137 MDA value in this zone is elevated due to the bremsstrahlung radiation.

For correlation purposes, the man-made radionuclides detected in this borehole (Cs-137, Co-60 and Eu-154) are shown in a separate plot. Only the zone at the 20-ft depth had Eu and Co. These plots are also shown with the calculated MDA values and the error bars.

Because the 20-ft zone indicated activity other than just Cs-137 and is suspected of containing Sr-90, the gamma-ray spectrum from this zone is provided as a separate plot. Two graphs are shown. The lower graph shows the entire gamma-ray spectrum from 0 to 3000 keV. Note the elevated low energy background. Prominent radionuclide energy peaks are also identified in this spectrum. The upper graph shows the same data on an expanded energy scale from 1100 to 1400 keV. Eu and Co peaks are identified in this graph.

The natural gamma logs (K-40, U-238, Th-238) are provided on a separate plot to permit correlation of these

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data with geology. The error bars representing the 95 percent confidence interval are shown so the reviewer can understand the significance of any variations in the vertical profile. Calculated MDA values are shown as open circle data points. The K-40 concentration is well above the corresponding MDA value, but this is not the case for U-238 or Th-232, because they have much lower specific activities. At the 20-ft depth, the U-238 MDA value is higher than the concentration, so no values are reported for this region. On the Th graph, the MDA value is shown as 0 at many depth locations. This is a result of an error in the spectrum analysis program, and the 0 MDA values should be ignored. The problem with the software has been corrected by the manufacturer, and future data will be correct.

The combination plot shows the Cs-137 concentration, the natural gamma logs, and the total gamma log plotted with the most recent Tank Farms gross gamma log.